been critical enough to be of any value to the anthropologist.

Prof. Naville is quite justified in congratulating (on the introduction which he prefixes to the volume) Mrs. Tirard on the extent of her knowledge of the Egyptian religious writings. It is her uncritical treatment of her own knowledge that we regret. There are few actual mistakes in matters of fact in the book, the most serious perhaps being the statement that the word *makheru*, "justified," is never used of the living, only of the dead; this is incorrect, as instances of *makheru* being used of the living are known. In a matter of faith rather than of reason, we do not share her belief that the "Prince of Wales's Feathers" are derived from the Egyptian feather symbolical of "Truth," or rather, "Right." Where are the intermediate stages between the old Egyptian feather-emblem and the day when the Black Prince did *not* take the three ostrich plumes from the helmet of the slain King of Bohemia? For we know that at Poitiers the blind king's crest was an eagle's wing, and that the picturesque legend of the origin of the Prince of Wales's Feathers has no basis in fact.

In her citations, Mrs. Tirard usually follows the masterly translation of Prof. Naville.

ANATOMY OF SEDGES.

Anatomy of the British Carices. By F. C. Crawford. Pp. xiv+124+xx plates. (Edinburgh: Oliver and Boyd, printed for private circulation, 1910.) Price 7*s*. 6*d*. net.

FRANCIS CRAWFORD was an enthusiastic worker in pursuits that attracted him; a remarkable man in that, after success in business enabled him to retire at forty-five, he could crowd so much acquisition of natural history knowledge and collections into the remaining twelve years of his life. Botanist, ornithologist, geologist—an all too brief biographical sketch of the author precedes the introduction by Prof. Balfour, who, as his lifelong friend, gives in a few touches fuller insight into the lovable character of the man. His sudden death, soon after the MS. was in the printer's hands, in February, 1908, deprived the work of the author's revision; and Prof. Balfour, who edited it, deemed it best, in spite of its unconventional phraseology, to let the book go forth "as Frank Crawford wrote it."

Crawford had no laboratory training, and, taking to botanical work late in life, could not readily acquire the use of its technical terms, or always consent to their fitness. "If people can't understand plain terms," he used to say, when his vernacular expressions were criticised, "so much the worse for them." This accounts for the frequent blend of scientific and homely phrases. The section of a midrib (p. 49) is described as a "round knob with a blunt point"; the stem of *C. remota* (p. 37) is "roundish and difficult to define, very bumpy"; the section of a leaf of *C. hirta* is "long, narrow, twisting about"; and in another species the "vascular bundles . . . don't reach to the epidermis." But these quaintnesses would not puzzle any reader.

What is a more troublesome deviation from usage will be found in the abbreviations and technical terms that need explaining, being relegated to casual footnotes. What is the meaning of the sentence on p. 8, "The bundle of *vulpina* var. *nemorosa* is in the median plane, but the patch of sch. does not reach to the apex, there is therefore a point of par."? The reader looks in vain for a list of abbreviations; it is in footnotes on pp. 2, 7, that to the two used here and constantly further on he finds a clue. The terms "involute" and "revolute" bear the meaning of incurved and recurved (p. 4), while "lumen" is not explained at all.

Such minor flaws detract, however, but little from the real value of an admirable book, which has the great merit of being pioneer work, at least in regard to this genus. The field botanist will be grateful for the inside details of stem, leaf, and rhizome, of which for the most part he has been woefully ignorant. All these details are set forth in the clearest style, in type that leaves nothing to be desired.

By Prof. Balfour's advice, Crawford tells us in his introduction, he collected, with the help of the Rev. E. S. Marshall and some others, fresh material to work on in preference to dried herbarium specimens. He first photographed a flower portion, and put other portions in spirit for winter work. From these he took sections of the stem, leaf, rhizome, and root, and prepared photomicrographs of the best, magnifying about 40 diameters. Little or nothing was obtained from dissecting the flowers; these are therefore not touched on in the "Anatomy." Many sections of the other parts were selected to figure, and with drawings of highly magnified stomata, &c., occupy twenty plates. These are done with a clearness of definition and a fidelity of detail that reflect great credit on both photographer and engraver.

The description of the figures in the plates, p. 115 is concise and accurate enough, but the numbers of the plates might have been added for convenience of reference, and as the species in this list of figures are in no order, and several occur again and again, the index should have embraced these pages as well as the rest.

In the special anatomy, as Crawford terms his descriptive account of the species, which forms the body of the work, each part of the plant in section (below the inflorescence) is given in detached paragraphs. *C. chordorrhiza*, Ehrh., is a capital example, being fully illustrated as well as minutely described. Crawford discovered in this species remarkable divergences between its aërial and underground rhizomes. There is no doubt where this came from, as there is but one British locality. The same with *C. trinervis*, which he collected at Ormesby by the present writer's direction. But the locality is a *desideratum* in almost every case, and might be supplied from the labelled specimens or photographs, which have been deposited at the Royal Botanic Garden, Edinburgh.

Most interesting is the success attained in differentiating more thoroughly the triad so perplexing to novices, *C. laevigata*, Sm., *binervis* and *distans*; in confirming on the whole the suspected origin of several hybrids, and in testing the claims of some varieties. Among these last the evidence does not

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support the alleged distinction between *C. vulpina* and its var. *nemorosa, C. canescens,* and its var. *robustior, C. diandra* and its var. *Ehrhartiana*; shows some difference between *C. Goodenowii* and var. *juncella,* much more between *C. binervis,* Sm., and var. *Sadleri,* Linton, which are farther apart than has been supposed.

This posthumous work, which throws more light on the *Carices* than most of us expected, owes its inception and completion to its distinguished editor, but it is a fine memorial of the persevering toil and ability of its lamented author, which must find its way into the hands of every botanist who pretends to a knowledge of the genus. EDWARD F. LINTON.

TABLES OF SYMMETRIC FUNCTIONS.

The Symmetric Function Tables of the Fifteenthic, including an Historical Summary of Symmetric Functions as Relating to Symmetric Function Tables. By Prof. F. F. Decker. Pp. 16+tables. (Washington, D.C.: Carnegie Institution, 1910.)

THE publication of this paper is an example of the excellent work that is being done by the Carnegie Institution of Washington, over a wide field of science, under the fostering care of Dr. R. S. Woodward.

The formation of Symmetric Function Tables dates from the first decade of the nineteenth century, when Meyer Hirsch gave them up to and including the 10^{ic}. These tables give the expression of a symmetric function of the quantities, $\alpha_1, \alpha_2, \ldots \alpha_{10}$, in terms of the elementary symmetric functions thereof, $p_1, p_2 \ldots p_{10}$, where

$$(x-\alpha_1)(x-\alpha_2)\ldots(x-\alpha_{10})=x^{10}-p_1x^9+\ldots+p_{10}.$$

According to modern notation and nomenclature a function

$$\Sigma\alpha_1{}^{\pi_1}\alpha_2{}^{\pi_2}\ldots\alpha_{10}{}^{\pi_{10}} \text{ or } (\pi_1\pi_2\ldots\pi_{10})$$

is thus expressed in terms of quantities

$$p_s=\Sigma\alpha_1\alpha_2\ldots\alpha_s \text{ or } (1^s),$$

the exponents of the quantities, α under the sign of summation being merely assembled in a bracket.

Ex. gr. $(2^2)=(1^2)^2-2(1)(1^3)+2(1^4)$,

and it will be observed that each term on the eight involves four units, and each is said to be a separation of (1^4). Mr. Decker's tables, like the earlier ones to which he refers, express all the functions $(\pi_1\pi_2\ldots)$, where $\Sigma\pi=15$ in terms of separations of (1^{15}), and a reader of his historical summary might suppose that nothing further had been done in the way of tables of symmetric functions. The facts are quite otherwise, for several remarkable extensions have been made to which Mr. Decker makes no reference whatever. So far back as 1888, in the *American Journal of Mathematics,* an analogous theory was shown to exist in regard to the separations of any partition whatever, and a complete set of tables, direct and inverse, up to weight six inclusive, was given in the *Journal*; a law of symmetry corresponding to the Cayley-Betti law and several other laws of symmetry were established. For example, one row for weight six and the separable partition (321) is:—

$$2(51)=(3)(21)+(2)(31)-(1)(32)-(321).$$

It was also shown that the weight might be zero or negative, and the separable partitions involve zero and negative parts without interference with the construction of the tables or with their fundamental properties.

Further, also in the Phil. Trans., R.S., 1890, the tables and properties were extended to the symmetric functions of several systems of quantities and specimen tables were given. It is necessary to say so much, as otherwise a reader might be grievously misled.

The historical summary in regard to a single system of quantities and the separations of (1^n) is well given by Mr. Decker. He is in error in ascribing formulas for calculating the constituents in each of the first four lines or columns to Roe; the first of these is nothing more than Waring's law, extended by the law of symmetry; the others are readily obtainable from it, and have long been in use by calculators.

The chief use of the formation of tables of these functions has been that the construction has led to the discovery of new theorems which have been of use in other departments of mathematics; in particular, remarkable differential operators were thus brought to light which have been successful in opening up problems of the magic square description, which had defied analysts from Euler to Cayley. Also the theory of non-unitary symmetric functions was shown to involve that of the covariants of binary quantics.

It is disappointing to find that Mr. Decker's laborious work with the 15^{ic} has not resulted in the discovery of theorems of wide application; this is not surprising, because it is fairly certain that previous workers have taken the principal plums out of this particular orchard; but, this being so, there does not appear to be any sufficient reason for continuing this series of tables.

Mr. Decker's table is beautifully produced, and he seems, while detecting errors or misprints in the lower tables, to have carried out a good system of checks to ensure freedom from error in his own.

P. A. M.

WORKSHOP MATHEMATICS.

Shop Problems in Mathematics. By W. E. Breckenridge, S. F. Mersereau, and C. F. Moore. Pp. vii+280. (Boston and London: Ginn and Co.) Price 4s. 6d.

THE authors' aims in producing this book have been to impart to the student information in regard to the more important points in shop work, such as the names of the parts of machines used in wood and metal working, together with the materials employed, and also to give a thorough training in the mathematical operations that are useful in shop practice and science. In carrying out these ideas, about two-thirds of the space available are occupied in calculations applied to timber, house building, machines, pattern-making, and foundry work, forgings, screws, and screw-cutting, and the gas engine. The latter part of the book is taken up with a review of calculation with short methods.

The book is decidedly American in its arrangement,

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